Why Fraunhofer IAF?

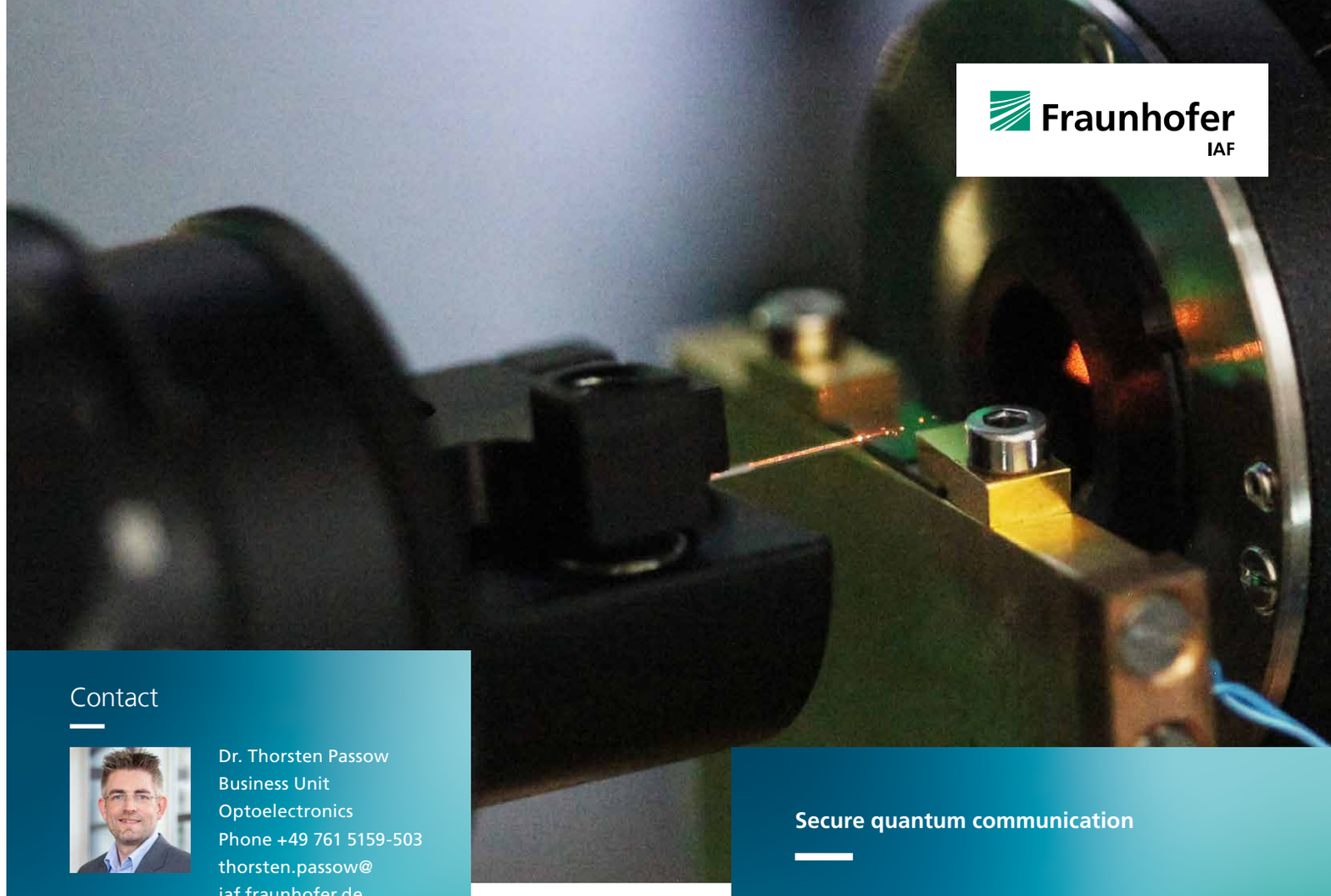
Fraunhofer IAF has decades of experience in the epitaxy of high-quality GaAs-based heterostructures as well as in the process technology of various III-V semiconductor materials for the realization of waveguide structures. In addition, we use in-house developed and commercial softwares for optical simulation and design of Bragg reflection waveguides.

Measurement setups equipped with tunable 780 and 1550 nm lasers and highly efficient superconducting nanowire single photon detectors allow the comprehensive characterization of waveguides for the generation of entangled photon pairs.

What we offer:

We develop III-V semiconductor based Bragg reflection waveguides for entangled photon pair generation. Depending on your application purposes, we can provide you single chips, or compact modules including pump source.

We look forward to hearing from you to explore the suitability of our entangled photon pair sources for your specific application!



Fraunhofer IAF

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Secure quantum communication

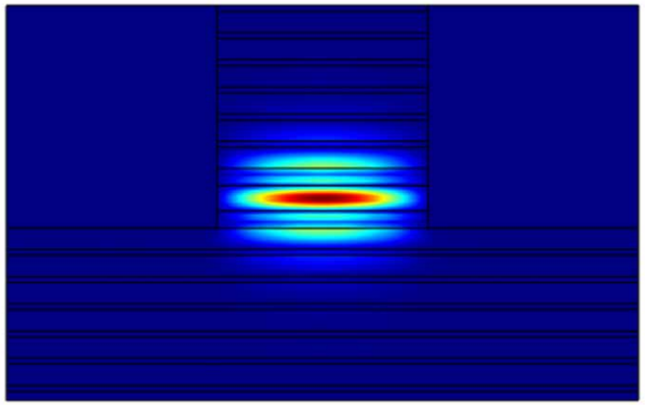
Compact on-chip sources for entangled photons

Compact entangled photon pair sources

At Fraunhofer IAF, we develop compact on-chip photon pair sources that can be integrated into photonic circuits. This is a promising concept for secure quantum communication.

Motivation

Entangled photon pairs are the basis for quantum technology applications. For practical use outside of the laboratory, miniaturized sources for entangled photons are required. At Fraunhofer IAF, we therefore strive for the optimal design and fabrication of waveguides based on the semiconductor material aluminum gallium arsenide (AlGaAs) for the generation of entangled photons with the long-term goal of a miniaturized photon source.



Simulated mode profile of a Bragg reflection light wave in an AlGaAs Bragg reflection ridge waveguide.

Quantum entangled photon pair sources based on AlGaAs Bragg reflection waveguides

We endeavor to integrate multiple functions required for quantum communication into just one chip. These functions include generation, manipulation, and detection of single and entangled photons. For this purpose, we design, epitaxially grow, fabricate and investigate AlGaAs-based photon sources and waveguides. These photon sources can generate photon pairs with high quality entanglement at a precisely defined wavelength.

The wavelength of the generated photons depends very sensitively on the actual layer thicknesses and compositions of the waveguides, therefore accurate control of the epitaxy of AlGaAs-based Bragg reflection waveguides is essential.

AlGaAs — aluminum gallium arsenide

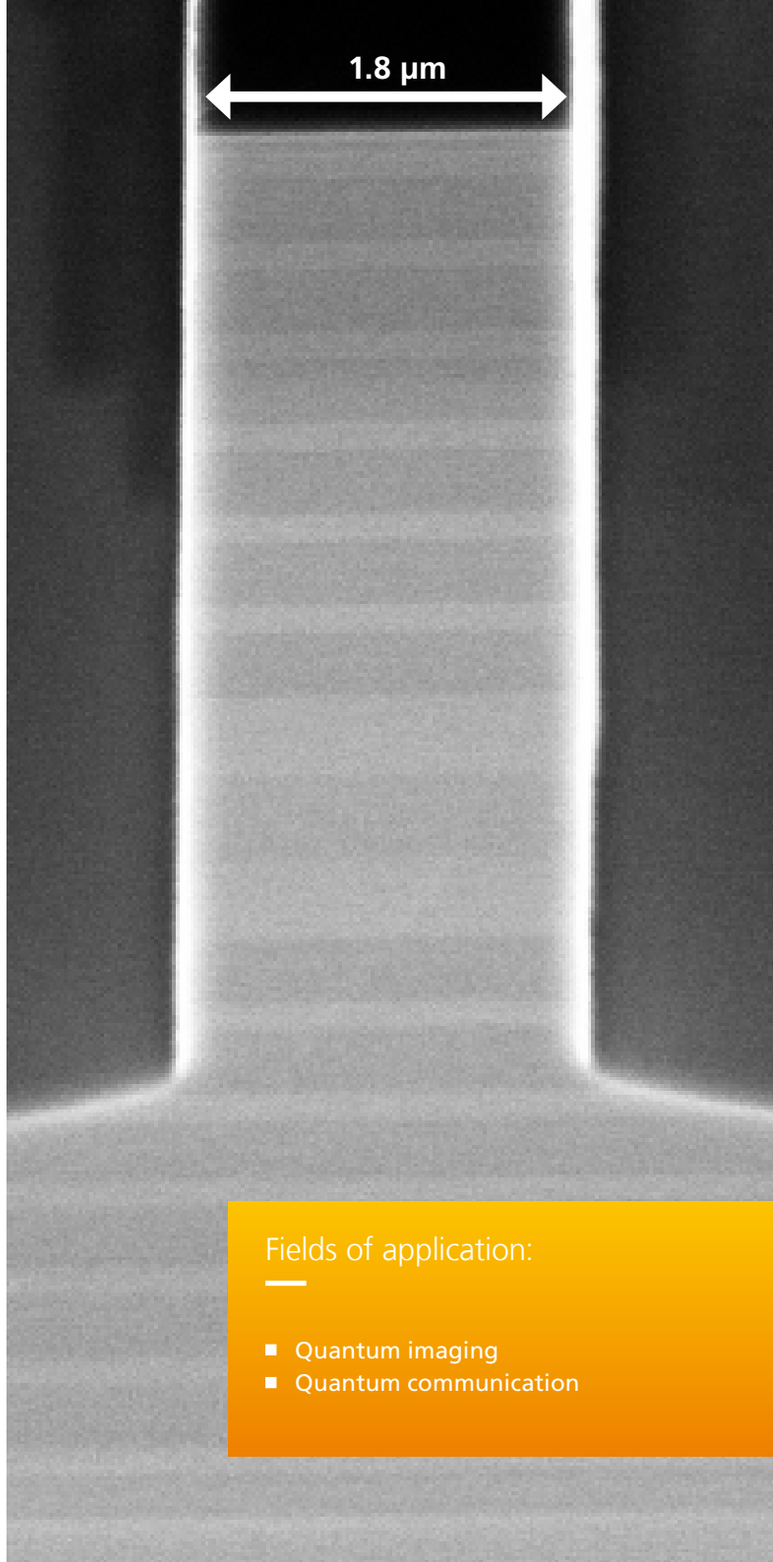
The semiconductor material AlGaAs has nonlinear properties that a high-frequency photon in the material can spontaneously split into two low-frequency photons. These low-frequency photon pairs can be quantum-mechanically entangled.

AlGaAs Bragg reflection waveguides enable integration with other optical and electronic components, e.g. pump laser diode, at chip level. This enables a particularly compact design, which fulfills a prerequisite for use in practice.

Features

- Telecom C-Band (1530–1565 nm)
- Waveguide width 1.5 to 5 µm
- Waveguide depth 3 to 6 µm
- Chip size of a few square millimeters

Right side: SEM image of the facet of a cleaved AlGaAs Bragg reflection ridge waveguide.



Fields of application:

- Quantum imaging
- Quantum communication